

Semi-annual Technical Report for NASA NAG 5-1684  
Prepared by Dr. Lynn R. Cominsky, Principal Investigator  
August 1, 1993

IN-89-CR

185967

This report covers the period January 15, 1993 through August 1, 1993 for NASA grant NAG 5-1684 through ROSAT Guest Investigator Program, for the project "ROSAT Observations of the Binary Be-star/Radio Pulsar PSR1259-63", Dr. Lynn R. Cominsky, Principal Investigator, Department of Physics and Astronomy, Sonoma State University, Rohnert Park, CA 94928. This grant was a financial continuation of a previous proposal entitled "ROSAT Observations of MXB 1659-29 and EXO 0748-676", for which Dr. Cominsky was a Co-investigator. Work was done on both projects during this time period. p-1

We have now received the standard output for both the initial 10,713 second observation of PSR1259-63 (which occurred during 8/30/92 - 9/4/92) and the subsequent 36,108 second observation (during 2/7-16/93). The source was detected at the rate of 0.02 counts per second, or about 200 total photons in the first observation, and at about 0.03 counts per second for a total of 1200 additional photons during the second observation. In addition, significant variability, both temporal and spectral has occurred during the second data set. No pulsations at the radio period were found, with upper limits of 5 - 10%. This is in marked contrast to the lack of detection in observations made by Bailes et al., during AO2, on 2/28/92.

We believe that the lack of pulsations, combined with the extreme variability in the X-ray flux rules out rotational spin down energy as a possible source of the X-ray emission. In addition, the flux is too strong (factors of 20 - 500 depending on the spectral model chosen) and too hard to be consistent with coronal emission from the Be-star companion, SS2883. Accretion at a low level is possible, but the lack of pulsations and extremely rapid, 47 ms spin period of the pulsar tend to rule out this interpretation. The most likely cause of the X-ray emission is therefore a shocked pulsar wind, as was seen from PSR1957+20. This is difficult, but not impossible to explain for this more widely separated binary. It is possible that the interaction between the relativistic pulsar wind and that from the Be-star is stronger and more complex than was previously believed. This result could have major implications for evolutionary scenarios which connect the millisecond radio pulsars to the Be-X-ray binaries.

The observational results have been presented, in poster form, at the 182nd meeting of the AAS, held in Berkeley on 6 - 10 June, 1993. They have also been presented at the recent meeting of the Astronomical Society of the Pacific on Interacting Binary Stars, and a short conference paper is in preparation for inclusion in the proceedings of this meeting. Further consideration of the evolution of the system is the subject of a talk submitted to be given at the upcoming Maryland meeting on the Evolution of X-ray Binaries (October 1993). (Abstracts are attached.) A formal research paper is in preparation for submission to the Astrophysical Journal, Letters, and should be submitted by October, 1993. We have received a no-cost extension through 9/94 to allow the publication of these exciting results.

We have also analyzed the eclipse transition observed from EXO 0748-676, and this work is the subject of an abstract submitted to the Evolution of X-ray Binaries meeting, "ROSAT Measurement of the Evolving Orbital Period in the Low Mass X-ray Binary EXO0748-676" by Hertz, Ly, Wood and Cominsky.